PHYTOTOXICOLOGY ASSESSMENT SURVEY IN THE VICINITY OF CANADA BRICK, BURLINGTON - 1990

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Report prepared by:

Phytotoxicology Section
Air Resources Branch
Ontario Ministry of the Environment

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Introduction

A survey was conducted by the Phytotoxicology Section, Air Resources Branch, on August 15, 1990 in the vicinity of Canada Brick (CB), Burlington, to determine the effects of fluoride emissions on surrounding vegetation. The survey was requested by the MOE Central Region because previous surveys (1986, 1987 & 1989) have shown that fluoride emissions from CB have increased since expansion of the brick production facilities in late 1986 through mid-1987.

The east and north boundaries of CB lie adjacent to the Bronte River Valley. The west boundary borders CNR tracks and is neighboured to the immediate west by scrub land and commercial/industrial properties. Neighbouring the southern boundary were commercial and residential properties abutting on Dundas St. (see figure).

Sampling and Injury Assessment

On August 15, 1990, tree foliage for fluoride analysis was collected from exposed middle branches at sites close to CB (Sites 1 to 7 & 12) as well as at more remote sites (Sites 8, 9, 11, 14, 15 & 16). Sampling of forage Sites 10 and 13 was discontinued in 1989. The above-noted tree foliage sites were sampled in previous years, except Site 16 which was established in 1990. All sites, except Sites 1, 2 and 3, were situated off company property (see figure). Duplicate samples were collected at all sites except Sites 3, 5, 6 and 12, where four samples per site were collected. Standard sampling procedures were followed at all sites.

Foliage of trees and other vegetation known to be sensitive to fluoride in the vicinity of the collection sites was inspected for fluoride injury.

The foliage samples were returned to the Phytotoxicology Laboratory for processing. All samples were processed on a not washed basis. The foliage samples were oven dried, ground and stored in glass jars. They were then submitted to the MOE Laboratory Services Branch for analysis of fluoride.

Analytical Results

Table 1 summarizes the 1986 through 1990 August fluoride results. The tree foliage results in 1990, as in previous years, displayed a decreasing fluoride concentration pattern with increasing distance from the company. The highest fluoride levels were detected at Site 2 (240 ppm) and Site 3 (248 ppm). These sites bordered the east side of the entrance road to CB and were east to southeast of the kilns and north of Hwy. 5. Just east of Site 3 there was a residential property. Off company property, the highest fluoride level was found at Site 5 (102 ppm) in the residential area along the south side of Hwy. 5.

The fluoride levels at all but the more remote sites (9, 11 & 14) were in excess of the 15 ppm Phytotoxicology Section Upper Limit of Normal (ULN) rural guideline. The highest foliar levels (240 & 248 ppm), which were found by the entrance road to CB, were about 16 times as high as the guideline.

The mean and standard deviation were calculated for Sites 3, 5, 6 and 12 (four samples per site). The standard deviations were in the range of 9 to 17 ppm, reflecting the variability of fluoride in foliage.

In 1990, foliar fluoride levels were increased from 1986 through 1989 levels at Sites 2, 3 & 15, to the neighbouring east to east-southeast of CB. In spite of the increased concentration at these three sites, a reduction in fluoride was found at most sites, with the greatest reduction occurring at Sites 7 and 8 to the immediate west-southwest. The yearly means calculated for sites neighbouring CB show that the foliar fluoride levels in the survey area were slightly reduced overall in 1990 compared to 1987 and 1989. The 1990 results, at most sites, were elevated above the pre-expansion levels of 1986.

The range in particulate removal values (percent particulate washed from the foliage samples) which were found at sites neighbouring CB in earlier years was 0-41% (1986), 31-62% (1987) and 3-32% (1989). Particulate removal values could not be calculated from the 1990 data because the samples were (accidently) not separated into washed and not-washed subsamples in the Phytotoxicology Laboratory. Climatic (rainfall) conditions accounted for some of the variation between the annual particulate removal data.

Injury Assessment Findings

Foliar inspections in the survey area over the years consistently revealed injury typical of fluoride toxicity, primarily on wild grape foliage. In 1990, the most severe injury on wild grape was observed to the immediate east, southeast and west of the company in the vicinity of Sites 1, 2, 3 and 7 (Sites 1, 2, & 3 were located on company property). The severity of injury in these areas was trace (0-1%) to light (2-10%), except near Sites 1 and 7 where wild grape plants had light to moderate (11-35%) injury overall. On more remote grape plants, including Sites 11 (960m SW) and 15 (700m E), fluoride-type injury either was absent or was only of trace severity on some leaves.

Foliar inspections in 1990 also revealed trace to light injury typical of fluoride on current year's Eastern white pine needles in the vicinity of Site 1. Trace fluoride-type injury also was observed on some current needles of some red pines and on some leaves of a few Manitoba maple trees on company property to the west of Site 2. In addition, silver maple at collection Sites 3 and 5 exhibited a few leaves with trace terminal injury, as did silver maple at the more remote Site 11. However, as the fluoride level was quite low at Site 11 (13 ppm), the terminal injury observed was not likely related to fluoride emissions. Gladiolus plants at Site 5 also exhibited some injured leaves with trace injury overall. Other vegetation inspected in the survey area did not display any foliar injury attributable to fluoride emissions.

The degree and extent of fluoride-type injury to vegetation in the survey area was fairly similar to that observed in 1987 and 1989.

Weather Data and Discussion

Table 2 summarizes the wind and rainfall data, that was obtained from the closest weather stations, for June through August 1986 to 1990. The wind data for the Oakville Southeast Station revealed a slight reduction in NW and W winds in 1990 (44 %) compared to 1986 (53 %), 1987 (55%) and 1989 (46%). The most pronounced wind reduction occurred in August. The rain data for the Toronto International Airport revealed that the slight wind reduction in 1990 was accompanied by an increase in rainfall relative to 1989, with August being the wettest month in 1990 (June-August). This suggests that weather conditions likely contributed to the reduction in vegetation fluoride levels in the survey area in 1990.

Summary

In summary, the 1990 survey around Canada Brick, Burlington, revealed a reduction in foliar fluoride levels overall in the survey area relative to 1987 and 1989. The climatic data suggested that weather conditions likely contributed to this reduction. Foliar inspections revealed no major change in the degree or extent of fluoride-type injury on vegetation in the survey area compared to 1987 and 1989. The most adverse effects, as in previous years, were confined to the immediate area of the company.

Table 1:

Average* Fluoride Concentration (ug/g, dry wt.) Detected in Unwashed Tree Foliage in the Vicinity of Canada Brick (CB), Burlington - 1990

Site No.	Distance & Direction from CB	Foliage Type	Year 1986	1987	1989	1990
		Sites Neighbouring CB				
1	350m NE	Sugar Maple	43	127	107	54
2	280m E	Sugar Maple	87	219	200	240
3	400m ESE	Silver Maple	70	229	160	248
4	550m ESE	Manitoba Maple	33	69	64	66
5	540m SE	Silver Maple	35	131	135	102
6	540m SE	Manitoba Maple	20	58	68	50
7	125m WSW	Apple	160	269	290	63
8	300m WSW	Sugar Maple	17	54	65	17
12	530m SE	Silver Maple	15	89	120	70
15	700m E	Manitoba Maple	23	32	26	53
16	380m WNW	Silver Maple	-	-	-	20
MEAN OF NEIGHBOURING SITES**			**50**	**128**	**124**	**96**
		More Remote Sites				
9	960m SSW	Manitoba Maple	8	9	9	7
		Silver Maple	-	-	-	11
11	960m SE	Silver Maple	12	13	26	13
14	1480m NNE	Sugar Maple	4	7	6	5

* The average shown for Sites 3, 5, 6 & 12 in 1990 is based on four sample replicates. All other averages are based on duplicate sample replicates.

** Calculated on basis of original sites, excluding new Site 16

Note: Sites 1, 2 and 3 are situated on company property

Table 2:

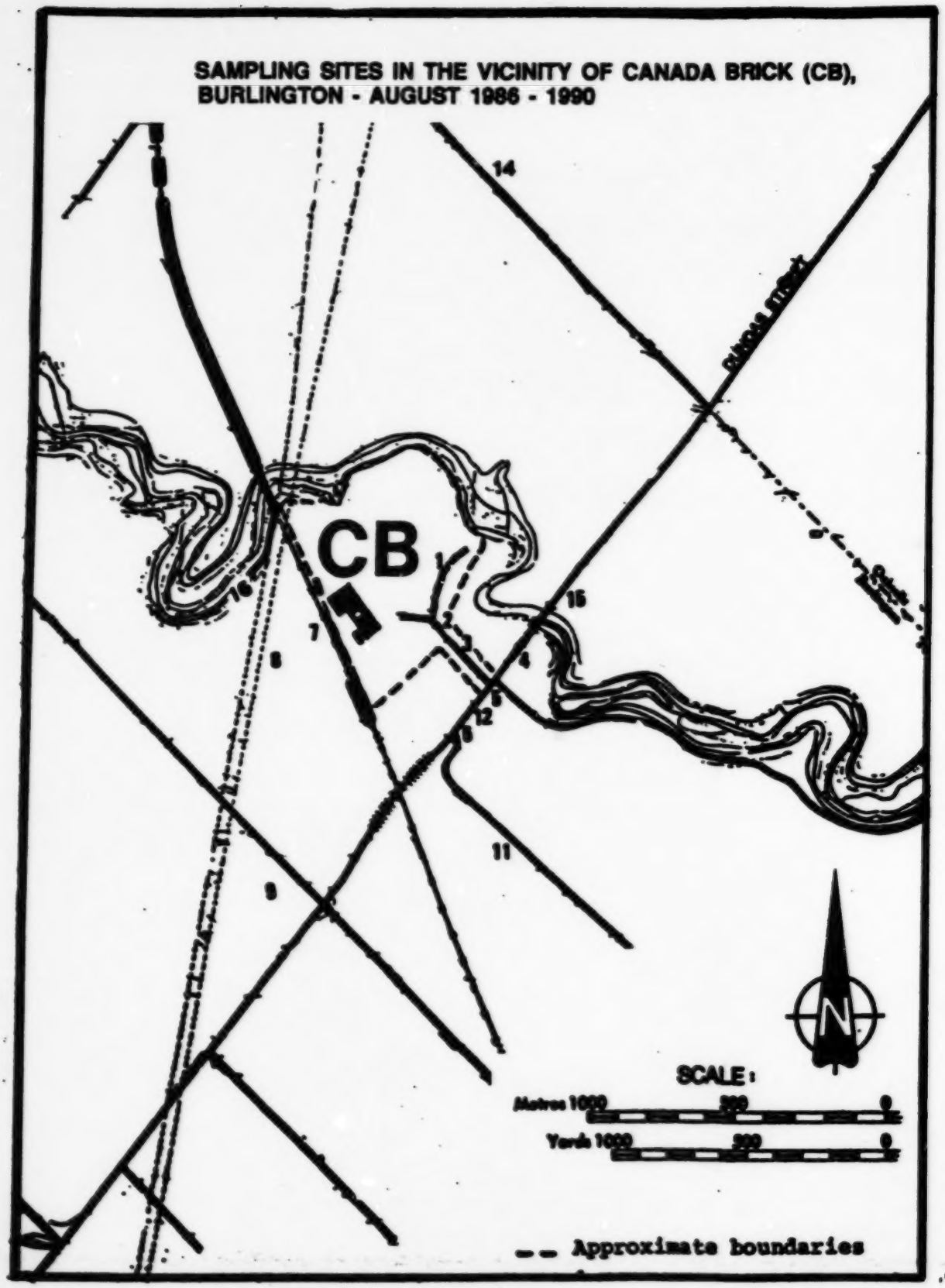
Summary of Wind and Precipitation Data for the MOE Oakville Southeast Station (Wind) and the Environment Canada Toronto Int'l Airport Station (Precipitation) - June through August 1986 to 1990

	June		July		August*		June-August*		
				% Wind Direction					
Year	W	NW	W	NW	W	NW	W	NW	
1986	24	29	22	27	29	26	25	28	
1987	31	25	31	23	30	26	31	24	
1989	25	19	17	24	32	28	23	23	
1990	27	21	23	25	5	21	21	23	
				Rainfall** Total (T) & Frequency (F)					
	T	F	T	F	T	F	T	F	
1986	74	12	96	11	84	9	254	32	(5)
1987	67	9	208	9	47	4	322	22	(0)
1989	83	13	68	6	44	7	195	26	(7)
1990	69	14	68	12	72	4	209	30	(4)

* Through to end of day preceding collection date: 1986 - August 20; 1987 - August 27; 1989 - August 16; 1990 - August 15

** Rain as millimeters; Frequency as number of days

( ) Number of days with rain during 14 day period prior to foliage collection


SAMPLING SITES IN THE VICINITY OF CANADA BRICK (CB),
BURLINGTON - AUGUST 1986 - 1990
CB
14
15
16
7
8
4
12
11
9
N
SCALE:
Metres 1000 500 0
Yards 1000 500 0
-- Approximate boundaries